Taxonomy of the order Bunyavirales : second update 2018

Maes, Piet

2019-03

Maes , P , Adkins , S , Alkhovsky , S V , Avsic-Zupanc , T , Ballinger , M J , Bente , D A , Beer , M , Bergeron , E , Blair , C D , Briese , T , Buchmeier , M J , Burt , F J , Calisher , C H , Charrel , R N , Choi , I R , Clegg , J C S , de la Torre , J C , de Lamballerie , X , DeRisi , J L , Digiaro , M , Drebot , M , Ebihara , H , Elbeaino , T , Ergunay , K , Fulhorst , C F , Garrison , A R , Gao , G F , Gonzalez , J-P J , Groschup , M H , Guenther , S , Haenni , A-L , Hall , R A , Hewson , R , Hughes , H R , Jain , R K , Jonson , M G , Junglen , S , Klempa , B , Klingstrom , J , Kormelink , R , Lambert , A J , Langevin , S A , Lukashevich , I S , Marklewitz , M , Martelli , G P , Mielke-Ehret , N , Mirazimi , A , Muehlbach , H-P , Naidu , R , Teixeira Nunes , M R , Palacios , G , Papa , A , Paweska , J T , Peters , C J , Plyusnin , A , Radoshitzky , S R , Resende , R O , Romanowski , V , Sall , A A , Salvato , M S , Sasaya , T , Schmaljohn , C , Shi , X , Shirako , Y , Simmonds , P , Sironi , M , Song , J-W , Spengler , J R , Stenglein , M D , Tesh , R B , Turina , M , Wei , T , Whitfield , A E , Yeh , S-D , Murilo Zerbini , F , Zhang , Y-Z , Zhou , X & Kuhn , J H 2019 , ' Taxonomy of the order Bunyavirales : second update 2018 ' , Archives of Virology , vol. 164 , no. 3 , pp. 927-941 . https://doi.org/10.1007/s00705-018-041

http://hdl.handle.net/10138/300295
https://doi.org/10.1007/s00705-018-04127-3

publishedVersion

Archives of Virology (2019) 164:927–941
https://doi.org/10.1007/s00705-018-04127-3

VIROLOGY DIVISION NEWS

Taxonomy of the order *Bunyavirales*: second update 2018

Piet Maes[1] · Scott Adkins[2] · Sergey V. Alkhovsky[3] · Tatjana Avšič-Županc[4] · Matthew J. Ballinger[5] · Dennis A. Bente[6] · Martin Beer[7] · Éric Bergeron[8] · Carol D. Blair[9] · Thomas Briese[10] · Michael J. Buchmeier[11] · Felicity J. Burt[12,13] · Charles H. Calisher[9] · Rémi N. Charrel[14] · Il Ryong Choi[15] · J. Christopher S. Clegg[16] · Juan Carlos de la Torre[17] · Xavier de Lamballerie[14] · Joseph L. DeRisi[18,19,20] · Michele Digiaro[21] · Mike Drebot[22] · Hideki Ebihara[23] · Toufic Elbeaino[21] · Koray Ergünay[24] · Charles F. Fulhorst[6] · Aura R. Garrison[25] · George Fú Gāo[26] · Jean-Paul J. Gonzalez[27] · Martin H. Groschup[28,29] · Stephan Günther[30] · Anne-Lise Haenni[31] · Roy A. Hall[32] · Roger Hewson[33] · Holly R. Hughes[34] · Rakesh K. Jain[35] · Miranda Gilda Jonson[36] · Sandra Junglen[37,38] · Boris Klempa[37,39] · Jonas Klingström[40] · Richard Kormelink[41] · Amy J. Lambert[34] · Stanley A. Langevin[42] · Igor S. Lukashevich[43] · Marco Marklewitz[37,38] · Giovanni P. Martelli[44] · Nicole Mielke-Ehret[45] · Ali Mirazimi[46] · Hans-Peter Mühlbach[45] · Rayapati Naidu[47] · Márcio Roberto Teixeira Nunes[48] · Gustavo Palacios[25] · Anna Papa[49] · Janusz T. Pawęska[50,51] · Clarence J. Peters[6] · Alexander Plyusnin[52] · Sheli R. Radoshitzky[25] · Renato O. Resende[53] · Víctor Romanowski[54] · Amadou Alpha Sall[55] · Maria S. Salvato[56] · Takahide Sasaya[57] · Connie Schmaljohn[25] · Xiǎohóng Shí[58] · Yukio Shirako[59] · Peter Simmonds[60] · Manuela Sironi[61] · Jin-Won Song[62] · Jessica R. Spengler[8] · Mark D. Stenglein[63] · Robert B. Tesh[6] · Massimo Turina[64] · Tàiyún Wèi[65] · Anna E. Whitfield[66] · Shyi-Dong Yeh[67] · F. Murilo Zerbini[68] · Yong-Zhen Zhang[28,29] · Xueping Zhou[69] · Jens H. Kuhn[70]

Published online: 20 January 2019

Abstract

In October 2018, the order *Bunyavirales* was amended by inclusion of the family *Arenaviridae*, abolishment of three families, creation of three new families, 19 new genera, and 14 new species, and renaming of three genera and 22 species. This article presents the updated taxonomy of the order *Bunyavirales* as now accepted by the International Committee on Taxonomy of Viruses (ICTV).

Handling Editor: Sead Sabanadzovic.

Michael J. Buchmeier, Rémi N. Charrel, J. Christopher S. Clegg, Juan Carlos de la Torre, Jean-Paul J. Gonzalez, Stephan Günther, Igor S. Lukashevich, Sheli R. Radoshitzky, Víctor Romanowski, Maria S. Salvato, Manuela Sironi, Mark D. Stenglein, Jens H. Kuhn: the members of the 2017–2020 International Committee on Taxonomy of Viruses (ICTV) *Arenaviridae* Study Group; Piet Maes, Scott Adkins, Juan Carlos de la Torre, Sandra Junglen, Amy J. Lambert, Gustavo Palacios, Takahide Sasaya, Yong-Zhen Zhang, Jens H. Kuhn: the members of the 2017–2020 ICTV *Bunyavirales* Study Group; Michele Digiaro, Toufic Elbeaino, Giovanni P. Martelli, Nicole Mielke-Ehret, Hans-Peter Mühlbach: the members of the 2017–2020 ICTV *Fimoviridae* Study Group; Piet Maes, Charles H. Calisher, Charles F. Fulhorst, Boris Klempa, Jonas Klingström, Jin-Won Song, Yong-Zhen Zhang: the members of the 2017–2020 ICTV *Hantaviridae* Study Group; Sergey V. Alkhovsky, Tatjana Avšič-Županc, Dennis A. Bente, Éric Bergeron, Felicity J. Burt, Koray Ergünay, Aura R. Garrison, Roger Hewson, Ali Mirazimi, Gustavo Palacios, Anna Papa, Janusz T. Pawęska, Amadou Alpha Sall, Jessica R. Spengler, Jens H. Kuhn: the members of the 2017–2020 ICTV *Nairoviridae* Study Group; Scott Adkins, Sergey V. Alkhovsky, Martin Beer, Carol D. Blair, Charles H. Calisher, Amy J. Lambert, Marco Marklewitz, Márcio Roberto Teixeira Nunes, Xiǎohóng Shí: the members of the 2017–2020 ICTV *Peribunyaviridae* Study Group; Holly R. Hughes, Matthew J. Ballinger, Mike Drebot, Roy A. Hall, Sandra Junglen, Stanley A. Langevin: the members of the 2017–2020 ICTV *Phasmaviridae* Study Group; Thomas Briese, Rémi N. Charrel, Xavier de Lamballerie, Hideki Ebihara, George Fú Gāo, Martin H. Groschup, Márcio Roberto Teixeira Nunes, Gustavo Palacios, Takahide Sasaya, Jin-Won Song: the members of the 2017–2020 ICTV *Phenuiviridae* Study Group; Il Ryong Choi, Anne-Lise Haenni, Miranda Gilda Jonson, Takahide Sasaya, Yukio Shirako, Tàiyún Wèi, Xueping Zhou: the members of the 2017–2020 ICTV *Tenuivirus* Study Group; Scott Adkins, Amy J. Lambert, Rayapati Naidu, Renato O. Resende, Massimo Turina, Anna E. Whitfield: the members of the 2017–2020 ICTV *Tospovirus* Study Group; Peter Simmonds: the 2017–2020 ICTV Chair of the Fungal and Protist Viruses Subcommittee; F. Murilo Zerbini: the 2017–2020 ICTV Chair of the Plant Viruses Subcommittee; the 2017–2020 ICTV Chair of the Animal dsRNA and ssRNA- Viruses Subcommittee.

Extended author information available on the last page of the article

Introduction

The virus order *Bunyavirales* was established in 2017 to accommodate related viruses with segmented, linear, single-stranded, negative-sense or ambisense RNA genomes classified into nine families [2]. Here, we present the changes that were proposed via an official ICTV taxonomic proposal (TaxoProp 2017.012M.A.v1.Bunyavirales_rev) at http://www.ictvonline.org/ in 2017 and were accepted by the ICTV Executive Committee (EC) in October 2018. These changes are now part of the official ICTV taxonomy as of October 2018.

Taxonomic changes at the order rank

In October 2018, the order *Bunyavirales* was amended by inclusion of the previously unassigned family *Arenaviridae*. The families *Feraviridae*, *Jonviridae*, and *Tospoviridae* were dissolved, and their genera (*Orthoferavirus*, *Orthojonvirus*, and *Orthotospovirus*) were renamed (*Feravirus*, *Jonvirus*, and *Tospovirus*, respectively) and moved into established families (*Feravirus*, *Jonvirus*→*Phasmaviridae* and *Tospovirus*→*Peribunyaviridae*). Three new families were created for novel invertebrate viruses: *Cruliviridae* for Wēnlǐng crustacean virus 9 (WlCV-9), *Mypoviridae* for Húběi myriapoda virus 5 (HbMV-5), and *Wupedeviridae* for Wǔhàn millipede virus 2 (WhMV-2) [4].

Taxonomic changes at the family rank

Fimoviridae

In 2018, no changes were made at the family rank.

Hantaviridae

In October 2018, the family was expanded by the addition of three new genera (*Loanvirus*, *Mobatvirus*, and *Thottimvirus*) for the species *Longquan orthohantavirus*, *Laibin orthohantavirus*, *Nova orthohantavirus*, *Quezon orthohantavirus*, *Imjin orthohantavirus*, and *Thottapalayam orthohantavirus* (now renamed *Longquan loanvirus*, *Laibin mobatvirus*, *Nova mobatvirus*, *Quezon mobatvirus*, *Imjin thottimvirus*, and *Thottapalayam thottimvirus*, respectively).

Nairoviridae

In October 2018, the family was expanded by the addition of two new genera, *Shaspivirus* and *Striwavirus*, for Shāyáng spider virus 1 (SySV-1) and Sānxiá water strider virus 1 (SxWSV-1) discovered in invertebrates, respectively [1, 4].

Peribunyaviridae

In October 2018, the family was expanded by the addition of the new genus *Shangavirus* for the species *Shuangao insect herbevirus* (now renamed *Insect shangavirus*).

Phasmaviridae

In October 2018, the family was expanded by the addition of the new genus *Inshuvirus* for the species *Shuangao insect orthophasmavirus 2* (now renamed *Insect inshuvirus*) and the new genus *Wuhivirus* for Wǔhàn insect virus 2 (WhIV-2) discovered in invertebrates [1].

Phenuiviridae

In October 2018, the family was expanded by the addition of the new genus *Banyangvirus* for the species *SFTS phlebovirus* (now renamed *Huaiyangshan banyangvirus*) and the new genera *Beidivirus*, *Horwuvirus*, *Hudivirus*, *Hudovirus*, *Mobuvirus*, *Pidchovirus*, and *Wubeivirus* for Húběi diptera virus 3 (HbDV-3), Wǔhàn horsefly virus (WhHV), Húběi diptera virus 4 (HbDV-4), Húběi lepidoptera virus 1 (HbLV-1), Mothra virus (MTHV), Pidgey virus (PGYV), and Húběi diptera virus 5 (HbDV-5)/Wǔhàn fly virus 1 (WhFV-1), respectively, discovered in invertebrates [1, 3, 4].

Summary

A summary of the current, ICTV-accepted taxonomy of the order *Bunyavirales* is presented in Table 1.

Table 1 ICTV-accepted taxonomy of the order *Bunyavirales* as of October 2018. Listed are all bunyaviruses that are classified into species

Genus	Species[¶]	Virus (abbreviation)[¶]
Family *Arenaviridae*		
Hartmanivirus	*Haartman hartmanivirus**	Haartman Institute snake virus 1 (HISV-1)
Mammarenavirus	*Allpahuayo mammarenavirus*	Allpahuayo virus (ALLV)
	Argentinian mammarenavirus	Junín virus (JUNV)
	Bear Canyon mammarenavirus	Bear Canyon virus (BCNV)
	Brazilian mammarenavirus	Sabiá virus (SBAV)
	Cali mammarenavirus	Pichindé virus (PICHV)
	Chapare mammarenavirus	Chapare virus (CHAPV)
	Cupixi mammarenavirus	Cupixi virus (CUPXV)
	Flexal mammarenavirus	Flexal virus (FLEV)
	Gairo mammarenavirus	Gairo virus (GAIV)
	Guanarito mammarenavirus	Guanarito virus (GTOV)
	Ippy mammarenavirus	Ippy virus (IPPYV)
	Lassa mammarenavirus	Lassa virus (LASV)
	Latino mammarenavirus	Latino virus (LATV)
	Loei River mammarenavirus	Loei River virus (LORV)
	Lujo mammarenavirus	Lujo virus (LUJV)
	Luna mammarenavirus	Luna virus (LUAV)
		Luli virus (LULV)
	Lunk mammarenavirus	Lunk virus (LNKV)
	*Lymphocytic choriomeningitis mammarenavirus**	Dandenong virus (DANV)
		lymphocytic choriomeningitis virus (LCMV)
	Machupo mammarenavirus	Machupo virus (MACV)
	Mariental mammarenavirus	Mariental virus (MRLV)
	Merino Walk mammarenavirus	Merino Walk virus (MRWV)
	Mobala mammarenavirus	mobala virus (MOBV)
	Mopeia mammarenavirus	Mopeia virus (MPOV)
		Morogoro virus (MORV)
	Okahandja mammarenavirus	Okahandja virus (OKAV)
	Oliveros mammarenavirus	Oliveros virus (OLVV)
	Paraguayan mammarenavirus	Paraná virus (PRAV)
	Pirital mammarenavirus	Pirital virus (PIRV)
	Ryukyu mammarenavirus	Ryukyu virus (RYKV)
	Serra do Navio mammarenavirus	Amaparí virus (AMAV)
	Solwezi mammarenavirus	Solwezi virus (SOLV)
	Souris mammarenavirus	souris virus (SOUV)
	Tacaribe mammarenavirus	Tacaribe virus (TCRV)
	Tamiami mammarenavirus	Tamiami virus (TMMV)
	Wenzhou mammarenavirus	Wēnzhōu virus (WENV)[1]
	Whitewater Arroyo mammarenavirus	Big Brushy Tank virus (BBRTV)
		Catarina virus (CTNV)
		Skinner Tank virus (SKTV)
		Tonto Creek virus (TTCV)
		Whitewater Arroyo virus (WWAV)
Reptarenavirus	*California reptarenavirus*	CAS virus (CASV)
	Giessen reptarenavirus	University of Giessen virus 1 (UGV-1)
		University of Giessen virus 2 (UGV-2)
		University of Giessen virus 3 (UGV-3)
	*Golden reptarenavirus**	Golden Gate virus (GOGV)
	Ordinary reptarenavirus	tavallinen suomalainen mies virus 2 (TSMV-2)

Table 1 (continued)

Genus	Species[¶]	Virus (abbreviation)[¶]
	Rotterdam reptarenavirus	ROUT virus (ROUTV)
		University of Helsinki virus 1 (UHV-1)
Family *Cruliviridae*		
Lincruvirus	*Crustacean lincruvirus**	Wēnlǐng crustacean virus 9 (WlCV-9)
Family *Fimoviridae*		
Emaravirus	*Actinidia chlorotic ringspot-associated emaravirus*	Actinidia chlorotic ringspot-associated virus (AcCRaV)
	*European mountain ash ringspot-associated emaravirus**	European mountain ash ringspot-associated virus (EMARaV)
	Fig mosaic emaravirus	fig mosaic virus (FMV)
	High Plains wheat mosaic emaravirus	High Plains wheat mosaic virus (HPWMoV)
	Pigeonpea sterility mosaic emaravirus 1	pigeonpea sterility mosaic virus (PPSMV)
	Pigeonpea sterility mosaic emaravirus 2	pigeonpea sterility mosaic virus 2 (PPSMV-2)
	Raspberry leaf blotch emaravirus	raspberry leaf blotch virus (RLBV)
	Redbud yellow ringspot-associated emaravirus	redbud yellow ringspot-associated virus (RYRaV)
	Rose rosette emaravirus	rose rosette virus (RRV)
Family *Hantaviridae*		
Orthohantavirus	*Amga orthohantavirus*	Amga virus (MGAV)[2]
	Andes orthohantavirus	Andes virus (ANDV)
		Castelo dos Sonhos virus (CASV)
		Lechiguanas virus (LECV = LECHV)
		Orán virus (ORNV)
	Asama orthohantavirus	Asama virus (ASAV)
	Asikkala orthohantavirus	Asikkala virus (ASIV)
	Bayou orthohantavirus	bayou virus (BAYV)
		Catacamas virus (CATV)
	Black Creek Canal orthohantavirus	Black Creek Canal virus (BCCV)
	Bowe orthohantavirus	Bowé virus (BOWV)
	Bruges orthohantavirus	Bruges virus (BRGV)
	Cano Delgadito orthohantavirus	Caño Delgadito virus (CADV)
	Cao Bang orthohantavirus	Cao Bằng virus (CBNV)
		Liánghé virus (LHEV)
	Choclo orthohantavirus	Choclo virus (CHOV)
	Dabieshan orthohantavirus	Dàbiéshān virus (DBSV)
	Dobrava-Belgrade orthohantavirus	Dobrava virus (DOBV)
		Kurkino virus (KURV)
		Saaremaa virus (SAAV)
		Sochi virus (SOCV)
	El Moro Canyon orthohantavirus	Carrizal virus (CARV)
		El Moro Canyon virus (ELMCV)
		Huitzilac virus (HUIV)
	Fugong orthohantavirus	Fúgòng virus (FUGV)
	Fusong orthohantavirus	Fǔsōng virus (FUSV)
	*Hantaan orthohantavirus**	Amur virus (AMRV)
		Hantaan virus (HTNV)
		Soochong virus (SOOV)
	Jeju orthohantavirus	Jeju virus (JJUV)
	Kenkeme orthohantavirus	Kenkeme virus (KKMV)
	Khabarovsk orthohantavirus	Khabarovsk virus (KHAV)
		Topografov virus (TOPV)
	Laguna Negra orthohantavirus	Laguna Negra virus (LANV)

Table 1 (continued)

Genus	Species[¶]	Virus (abbreviation)[¶]
		Maripa virus (MARV)
		Río Mamoré virus (RIOMV)
	Luxi orthohantavirus	Lúxī virus (LUXV)
	Maporal orthohantavirus	Maporal virus (MAPV)
	Montano orthohantavirus	Montaño virus (MTNV)
	Necocli orthohantavirus	Necoclí virus (NECV)
	Oxbow orthohantavirus	Oxbow virus (OXBV)
	Prospect Hill orthohantavirus	Prospect Hill virus (PHV)
	Puumala orthohantavirus	Hokkaido virus (HOKV)
		Muju virus (MUJV)
		Puumala virus (PUUV)
	Rockport orthohantavirus	Rockport virus (RKPV)
	Sangassou orthohantavirus	Sangassou virus (SANGV)
	Seoul orthohantavirus	gōu virus (GOUV)
		Seoul virus (SEOV)
	Sin Nombre orthohantavirus	New York virus (NYV)[3]
		Sin Nombre virus (SNV)
	Thailand orthohantavirus	Anjozorobe virus (ANJZV)
		Serang virus (SERV)[4]
		Thailand virus (THAIV)
	Tula orthohantavirus	Adler virus (ADLV)
		Tula virus (TULV)
	Yakeshi orthohantavirus	Yákèshí virus (YKSV)
Loanvirus	*Longquan loanvirus**	Lóngquán virus (LQUV)
Mobatvirus	*Laibin mobatvirus*	Láibīn virus (LAIV)
	*Nova mobatvirus**	Nova virus (NVAV)
	Quezon mobatvirus	Quezon virus (QZNV)
Thottimvirus	*Imjin thottimvirus*	Imjin virus (MJNV)
	*Thottapalayam thottimvirus**	Thottapalayam virus (TPMV)
Family *Mypoviridae*		
Hubavirus	*Myriapod hubavirus**	Húběi myriapoda virus 5 (HbMV-5)
Family *Nairoviridae*		
Orthonairovirus	*Artashat orthonairovirus*	Artashat virus (ARTSV)
	Chim orthonairovirus	Chim virus (CHIMV)
	Crimean-Congo hemorrhagic fever orthonairovirus	Crimean-Congo hemorrhagic fever virus (CCHFV)
	Dera Ghazi Khan orthonairovirus	Abu Hammad virus (AHV)[5]
		Abu Mina virus (AMV)
		Dera Ghazi Khan virus (DGKV)
		Sapphire II virus (SAPV)
	*Dugbe orthonairovirus**	Dugbe virus (DUGV)
		kupe virus (KUPEV)
	Hazara orthonairovirus	Hazara virus (HAZV)
		Tofla virus (TFLV)
	Hughes orthonairovirus	Caspiy virus (CASV)
		Farallon virus (FARV)
		Great Saltee virus (GRSV)
		Hughes virus (HUGV)
		Punta Salinas virus (PSV)
		Raza virus (RAZAV)
		Soldado virus (SOLV)

Table 1 (continued)

Genus	Species[¶]	Virus (abbreviation)[¶]
		Zirqa virus (ZIRV)
	Kasokero orthonairovirus	Kasokero virus (KASV = KASOV)
		Leopards Hill virus (LPHV)
		Yogue virus (YOGV)
	Keterah orthonairovirus	Gossas virus (GOSV)
		Issyk-kul virus (ISKV)
		Keterah virus (KTRV)[6]
		Uzun-Agach virus (UZAV)
	Nairobi sheep disease orthonairovirus	Nairobi sheep disease virus (NSDV)[7]
	Qalyub orthonairovirus	Bandia virus (BDAV)
		Geran virus (GERV)
		Qalyub virus (QYBV)
	Sakhalin orthonairovirus	Avalon virus (AVAV)
		Clo Mor virus (CMV = CLMV)
		Sakhalin virus (SAKV)
		Taggert virus (TAGV)
		Tillamook virus (TILLV)
	Tamdy orthonairovirus	Burana virus (BURV)
		Huángpí tick virus 1 (HpTV-1)
		Tamdy virus (TAMV)
		Tǎchéng tick virus 1 (TcTV-1)
		Wēnzhōu tick virus (WzTV)
	Thiafora orthonairovirus	Erve virus (ERVEV)
		Thiafora virus (TFAV)
Shaspivirus	*Spider shaspivirus**	Shāyáng spider virus 1 (SySV-1)
Striwavirus	*Strider striwavirus**	Sānxiá water strider virus 1 (SxWSV-1)
Family *Peribunyaviridae*		
Herbevirus	*Herbert herbevirus**	Herbert virus (HEBV)
	Kibale herbevirus	Kibale virus (KIBV)
	Tai herbevirus	Taï virus (TAIV)
Orthobunyavirus	*Acara orthobunyavirus*	Acará virus (ACAV)
		Moriche virus (MORV)
	Akabane orthobunyavirus	Akabane virus (AKAV)
		Sabo virus (SABOV)
		Tinaroo virus (TINV)
		Yaba-7 virus (Y7V)
	Alajuela orthobunyavirus	Alajuela virus (ALJV)
		Brus Laguna virus (BLAV)
		San Juan virus (SJV)
	Anopheles A orthobunyavirus	Anopheles A virus (ANAV)
		Arumateua virus (ARTV = ARMTV)
		Caraipé virus (CPEV = CRPV)
		Las Maloyas virus (LMV)
		Lukuni virus (LUKV)
		Trombetas virus (TRMV)
		Tucuruí virus (TUCV = TUCRV)
	Anopheles B orthobunyavirus	Anopheles B virus (ANBV)
		Boracéia virus (BORV)
	Bakau orthobunyavirus	Bakau virus (BAKV)
		Ketapang virus (KETV)

Table 1 (continued)

Genus	Species[¶]	Virus (abbreviation)[¶]
		Nola virus (NOLAV)
		Tanjong Rabok virus (TRV)
		Telok Forest virus (TFV)
	Batama orthobunyavirus	Batama virus (BMAV)
	Benevides orthobunyavirus	Benevides virus (BVSV = BENV)
	Bertioga orthobunyavirus	Bertioga virus (BERV)
		Cananéia virus (CNAV)
		Guaratuba virus (GTBV)
		Itimirim virus (ITIV)
		Mirim virus (MIRV)
	Bimiti orthobunyavirus	bimiti virus (BIMV)
	Botambi orthobunyavirus	Botambi virus (BOTV)
	*Bunyamwera orthobunyavirus**	Anadyr virus (ANADV)
		Batai virus (BATV)[8]
		Birao virus (BIRV)
		Bozo virus (BOZOV)
		Bunyamwera virus (BUNV)
		Cache Valley virus (CVV)
		Fort Sherman virus (FSV)
		Germiston virus (GERV)
		Ilesha virus (ILEV)
		Lokern virus (LOKV)
		Maguari virus (MAGV)
		Mboké virus (MBOV)
		Ngari virus (NRIV)[9]
		Northway virus (NORV)
		Playas virus (PLAV)
		Potosi virus (POTV)
		Santa Rosa virus (SARV)
		Shokwe virus (SHOV)
		Stanfield virus (STAV)
		Tensaw virus (TENV)
		Tlacotalpan virus (TLAV)
		Xingu virus (XINV)
	Bushbush orthobunyavirus	Benfica virus (BENV = BNFV)
		Bushbush virus (BSBV)
		Juan Díaz virus (JDV)
	Bwamba orthobunyavirus	Bwamba virus (BWAV)
		Pongola virus (PGAV)
	California encephalitis orthobunyavirus	Achiote virus (ACHOV)
		California encephalitis virus (CEV)
		infirmatus virus (INFV)
		Inkoo virus (INKV)
		Jamestown Canyon virus (JCV)
		Jerry Slough virus (JSV)
		Keystone virus (KEYV)
		Khatanga virus (KHATV)[10]
		La Crosse virus (LACV)
		Lumbo virus (LUMV)
		Melao virus (MELV)

Table 1 (continued)

Genus	Species[¶]	Virus (abbreviation)[¶]
		Morro Bay virus (MBV)
		San Angelo virus (SAV)
		Serra do Navio virus (SDNV)
		snowshoe hare virus (SSHV)
		South River virus (SORV)
		Ťahyňa virus (TAHV)
		trivittatus virus (TVTV)
	Capim orthobunyavirus	Capim virus (CAPV)
	Caraparu orthobunyavirus	Apeú virus (APEUV)
		Bruconha virus (BRUV)
		Caraparú virus (CARV)
		El Huayo virus (EHUV)
		Itaya virus (ITYV)
		Ossa virus (OSSAV)
		Vinces virus (VINV)
	Catu orthobunyavirus	Catú virus (CATUV)
	Estero Real orthobunyavirus	Estero Real virus (ERV)
	Gamboa orthobunyavirus	Calchaquí virus (CQIV)
		Gamboa virus (GAMV)
		Pueblo Viejo virus (PVV)
		Soberanía virus (SOBV)
	Guajara orthobunyavirus	Guajará virus (GJAV)
	Guama orthobunyavirus	Ananindeua virus (ANUV)
		Guamá virus (GMAV)
		Mahogany Hammock virus (MHV)
		Moju virus (MOJUV)
	Guaroa orthobunyavirus	Guaroa virus (GROV)
	Kaeng Khoi orthobunyavirus	Kaeng Khoi virus (KKV)
	Kairi orthobunyavirus	Kairi virus (KRIV)
	Koongol orthobunyavirus	koongol virus (KOOV)
		wongal virus (WONV)
	Madrid orthobunyavirus	Madrid virus (MADV)
	Main Drain orthobunyavirus	Main Drain virus (MDV)
	Manzanilla orthobunyavirus	Buttonwillow virus (BUTV)
		Cát Quế virus (CQV)
		Ingwavuma virus (INGV)
		Inini virus (INIV)
		Manzanilla virus (MANV)
		Mermet virus (MERV)
	Marituba orthobunyavirus	Gumbo Limbo virus (GLV)
		Marituba virus (MTBV)
		Murutucú virus (MURV)
		Nepuyo virus (NEPV)
		Restan virus (RESV)
		Zungarococha virus (ZUNV)
	Minatitlan orthobunyavirus	Minatitlán virus (MNTV)
		Palestina virus (PLSV)
	MPoko orthobunyavirus	M'Poko virus (MPOV)
		Yaba-1 virus (Y1V)
	Nyando orthobunyavirus	Nyando virus (NDV)

Table 1 (continued)

Genus	Species[¶]	Virus (abbreviation)[¶]
		Eretmapodites virus (ERETV)
	Olifantsvlei orthobunyavirus	Bobia virus (BIAV)
		Dabakala virus (DABV)
		Olifantsvlei virus (OLIV)
		Oubi virus (OUBIV)
	Oriboca orthobunyavirus	Itaquí virus (ITQV)
		Oriboca virus (ORIV)
	Oropouche orthobunyavirus	Facey's paddock virus (FPV)
		Iquitos virus (IQTV)[d]
		Madre de Dios virus (MDDV)
		Oropouche virus (OROV)
		Perdões virus (PDEV)
		Pintupo virus (PINTV)
		Utinga virus (UTIV)
		Utivé virus (UVV = UTVEV)
	Patois orthobunyavirus	Abras virus (ABRV)
		Babahoya virus (BABV)
		Pahayokee virus (PAHV)
		Patois virus (PATV)
		Shark River virus (SRV)
	Sathuperi orthobunyavirus	Douglas virus (DOUV)
		Sathuperi virus (SATV)
	Shamonda orthobunyavirus	Peaton virus (PEAV)
		Sango virus (SANV)
		Shamonda virus (SHAV)
	Shuni orthobunyavirus	Aino virus (AINOV)
		Kaikalur virus (KAIV)
		Shuni virus (SHUV)
	Simbu orthobunyavirus	Oya virus (OYAV)
		Simbu virus (SIMV)
	Tacaiuma orthobunyavirus	CoAr 1071 virus (CA1071V)
		CoAr 3627 virus (CA3626V)
		Tacaiuma virus (TCMV)
		Virgin River virus (VRV)
	Tete orthobunyavirus	Bahig virus (BAHV)
		Matruh virus (MTRV)
		Tete virus (TETEV)
		Tsuruse virus (TSUV)
		Weldona virus (WELV)
	Thimiri orthobunyavirus	Thimiri virus (THIV)
	Timboteua orthobunyavirus	Timboteua virus (TBTV)
	Turlock orthobunyavirus	Lednice virus (LEDV)
		Turlock virus (TURV)
		Umbre virus (UMBV)
	Wolkberg orthobunyavirus	Wolkberg virus (WBV)
	Wyeomyia orthobunyavirus	Anhembi virus (AMBV)
		BeAr 328208 virus (BAV)
		Cachoeira Porteira virus (CPOV)
		Iaco virus (IACOV)
		Macauã virus (MCAV)

Table 1 (continued)

Genus	Species[¶]	Virus (abbreviation)[¶]
		Rio Pracupi virus
		Sororoca virus (SORV)
		Taiassui virus (TAIAV)
		Tucunduba virus (TUCV)
		Wyeomyia virus (WYOV)
	Zegla orthobunyavirus	Zegla virus (ZEGV)
Shangavirus	*Insect shangavirus*	Shuāngào insect virus 1 (SgIV-1)
Tospovirus	*Groundnut bud necrosis tospovirus*	groundnut bud necrosis virus (GBNV)[11]
	Groundnut ringspot tospovirus	groundnut ringspot virus (GRSV)
	Groundnut yellow spot tospovirus	groundnut yellow spot virus (GYSV)[12]
	Impatiens necrotic spot tospovirus	impatiens necrotic spot virus (INSV)
	Iris yellow spot tospovirus	iris yellow spot virus (IYSV)
	Polygonum ringspot tospovirus	Polygonum ringspot virus (PolRSV)
	Tomato chlorotic spot tospovirus	tomato chlorotic spot virus (TCSV)
	*Tomato spotted wilt tospovirus**	tomato spotted wilt virus (TSWV)
	Watermelon bud necrosis tospovirus	watermelon bud necrosis virus (WBNV)
	Watermelon silver mottle tospovirus	watermelon silver mottle virus (WSMoV)
	Zucchini lethal chlorosis tospovirus	zucchini lethal chlorosis virus (ZLCV)
Family *Phasmaviridae*		
Feravirus	*Ferak feravirus**	Ferak virus (FERV)
Inshuvirus	*Insect inshuvirus**	Shuāngào insect virus 2 (SgIV-2)
Jonvirus	*Jonchet jonvirus**	jonchet virus (JONV)
Orthophasmavirus	*Kigluaik phantom orthophasmavirus**	Kigluaik phantom virus (KIGV)
	Nome phantom orthophasmavirus	Nome phantom virus (NOMV)
	Wuchang cockroach orthophasmavirus 1	Wǔchāng cockroach virus 1 (WcCV-1)
	Wuhan mosquito orthophasmavirus 1	Wǔhàn mosquito virus 1 (WhMV-1)
	Wuhan mosquito orthophasmavirus 2	Wǔhàn mosquito virus 2 (WhMV-2)
Wuhivirus	*Insect wuhivirus**	Wǔhàn insect virus 2 (WhIV-2)
Family *Phenuiviridae*		
Banyangvirus	*Huaiyangshan banyangvirus**	severe fever with thrombocytopenia syndrome virus (SFTSV)
Beidivirus	*Dipteran beidivirus**	Húběi diptera virus 3 (HbDV-3)
Goukovirus	*Cumuto goukovirus*	Cumuto virus (CUMV)
	*Gouleako goukovirus**	Gouléako virus (GOLV)
	Yichang insect goukovirus	Yíchāng insect virus (YcIV)
Horwuvirus	*Horsefly horwuvirus**	Wǔhàn horsefly virus (WhHV)
Hudivirus	*Dipteran hudivirus**	Húběi diptera virus 4 (HbDV-4)
Hudovirus	*Lepidopteran hudovirus**	Húběi lepidoptera virus 1 (HbLV-1)
Mobuvirus	*Mothra mobuvirus**	Mothra virus (MTHV)
Phasivirus	*Badu phasivirus**	Badu virus (BADUV)
	Phasi Charoen-like phasivirus	Phasi Chaeron-like virus (PCLV)
	Wuhan fly phasivirus[#]	
	Wutai mosquito phasivirus	Wǔtái mosquito virus (WtMV)
Phlebovirus	*Bujaru phlebovirus*	Bujaru virus (BUJV)
		Munguba virus (MUNV)
	Candiru phlebovirus	Alenquer virus (ALEV)
		Ariquemes virus (ARQV)
		Candirú virus (CDUV)
		Itaituba virus (ITAV)
		Jacundá virus (JCNV)

Table 1 (continued)

Genus	Species[¶]	Virus (abbreviation)[¶]
		Maldonado virus (MLOV)
		Morumbi virus (MR(M)BV)
		Mucura virus (MCRV/MRAV)
		Nique virus (NIQV)
		Oriximiná virus (ORXV)
		Serra Norte virus (SRNV)
		Turuna virus (TUAV)
	Chilibre phlebovirus	Cacao virus (CACV)
		Chilibre virus (CHIV)
	Frijoles phlebovirus	frijoles virus (FRIV)
		Joá virus (JOAV)
	Punta Toro phlebovirus	Buenaventura virus (BUEV)
		Campana virus (CMAV)
		Capira virus (CAPIV)
		Coclé virus (CCLV)
		Leticia virus (LTCV)
		Punta Toro virus (PTV)
	*Rift Valley fever phlebovirus**	Rift Valley fever virus (RVFV)
	Salehabad phlebovirus	Adana virus (ADAV)
		Adria virus (ADRV)
		Alcube virus
		Arbia virus (ARBV)
		Arumowot virus (AMTV)
		Medjerda Valley virus (MVV)
		Odrénisrou virus (ODRV)
		Olbia virus (OLBV)
		Salehabad virus (SALV)
		Bregalaka virus (BREV)
		Zaba virus (ZABAV)
	Sandfly fever Naples phlebovirus	Arrábida virus (ARRV)
		Balkan virus (BALKV)
		Fermo virus (FERV)
		Gordil virus (GORV)
		Granada virus (GRV = GRAV)
		Massilia virus (MASV)
		Punique virus (PUNV)
		Saddaguia virus (SADV)
		Saint-Floris virus (SAFV)
		sandfly fever Naples virus (SFNV)
		Tehran virus (THEV)
		Toscana virus (TOSV)
		Zerdali virus (ZERV)
	Uukuniemi phlebovirus	Chizé virus (CHZV)
		EgAN 1825-61 virus (EGAV)
		Fin V 707 virus (FINV)
		Oceanside virus (OCV = OCEV)
		Pontevès virus (PTVV)
		St. Abbs Head virus (SAHV)
		Uukuniemi virus (UUKV)
		Zaliv Terpenyia virus (ZTV)

Table 1 (continued)

Genus	Species[¶]	Virus (abbreviation)[¶]
Pidchovirus	*Pidgey pidchovirus**	Pidgey virus (PGYV)
Tenuivirus	*Echinochloa hoja blanca tenuivirus*	Echinochloa hoja blanca virus (EHBV)
	Iranian wheat stripe tenuivirus	Iranian wheat stripe virus (IWSV)
	Maize stripe tenuivirus	maize stripe virus (MStV = MSpV)
	Rice grassy stunt tenuivirus	rice grassy stunt virus (RGSV)
	Rice hoja blanca tenuivirus	rice hoja blanca virus (RHBV)
	*Rice stripe tenuivirus**	rice stripe virus (RSV = RStV)
	Urochloa hoja blanca tenuivirus	Urochloa hoja blanca virus (UHBV)
Wubeivirus	*Dipteran wubeivirus**	Húběi diptera virus 5 (HbDV-5)
	Fly wubeivirus	Wǔhàn fly virus 1 (WhFV-1)
Family *Wupedeviridae*		
Wumivirus	*Millipede wumivirus**	Wǔhàn millipede virus 2 (WhMV-2)

*Asterisks denote type species

[1]junior synonyms: Cardamones virus, Hǎinán Medical University virus, Xīngyì virus

[2]synonym: Artybash virus (ARTV)

[3]synonym: New York 1 virus (NY-1V)

[4]synonym: Jurong virus

[5]includes the strain previously referred to as Tunis virus (TUNV)

[6]includes the strain previously referred to as soft tick bunyavirus (STBV)

[7]includes the strain previously referred to as Ganjam virus (GANV)

[8]synonyms: Čalovo virus (CVOV), Chittoor virus (CHITV), Olkya virus, Olyka virus, UgMP-6830 virus

[9]includes the strain previously referred to as Garissa virus

[10]also mistakenly referred to in the literature as Chantanga virus (CHATV) and Chatanga virus (CHATV)

[11]synonym: peanut bud necrosis virus (PDNV)

[12]synonym: peanut yellow spot virus (PYSV)

[#]The virus of this species was moved into a new genus (*Wubeivirus*) and species (*Fly wubeivirus*), but due to a formal error, the species *Wuhan fly phasivirus* was not deleted. A taxonomic proposal to rectify this oversight has been submitted

[¶]Please note that viruses are real objects that are assigned to concepts that are called taxa. Species, genera, families, and orders are taxa. Taxon names are always italicized and always begin with a capital letter. Virus names, on the other hand, are not italicized and are not capitalized, except if the name or a name component is a proper noun. This column lists the virus names with their correct (lack of) capitalization. Lists of viruses within a given species are provisional at this point and will likely be amended in the near future

Acknowledgements We thank Laura Bollinger (NIH/NIAID Integrated Research Facility at Fort Detrick, Frederick, MD, USA) for critically editing the manuscript.

Funding This work was supported in part through Battelle Memorial Institute's prime contract with the US National Institute of Allergy and Infectious Diseases (NIAID) under Contract No. HHSN272200700016I (J.H.K.). This work was also funded in part by National Institutes of Health (NIH) contract HHSN272201000040I/HHSN27200004/D04 and grant R24AI120942 (R.B.T.).

Compliance with ethical standards

The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the US Department of the Army, the US Department of Defense, the US Department of Health and Human Services, or of the institutions and companies affiliated with the authors. In no event shall any of these entities have any responsibility or liability for any use, misuse, inability to use, or reliance upon the information contained herein. The US departments do not endorse any products or commercial services mentioned in this publication.

Conflict of interest The authors declare no conflicts of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

References

1. Li C-X, Shi M, Tian J-H, Lin X-D, Kang Y-J, Chen L-J, Qin X-C, Xu J, Holmes EC, Zhang Y-Z (2015) Unprecedented genomic diversity of RNA viruses in arthropods reveals the ancestry of negative-sense RNA viruses. Elife 4:e05378
2. Maes P, Alkhovsky SV, Bào Y, Beer M, Birkhead M, Briese T, Buchmeier MJ, Calisher CH, Charrel RN, Choi IR, Clegg CS, Torre JCDL, Delwart E, DeRisi JL, Bello PLD, Serio FD, Digiaro M, Dolja VV, Drosten C, Druciarek TZ, Du J, Ebihara

H, Elbeaino T, Gergerich RC, Gillis AN, Gonzalez J-PJ, Haenni A-L, Hepojoki J, Hetzel U, Hồ T, Hóng N, Jain RK, Vuren PJV, Jin Q, Jonson MG, Junglen S, Keller KE, Kemp A, Kipar A, Kondov NO, Koonin EV, Kormelink R, Korzyukov Y, Krupovic M, Lambert AJ, Laney AG, LeBreton M, Lukashevic IS, Marklewitz M, Markotter W, Martelli GP, Martin RR, Mielke-Ehret N, Mühlbach H-P, Navarro B, Ng TFF, Nunes MRT, Palacios G, Pawęska JT, Peters CJ, Plyusnin A, Radoshitzky SR, Romanowski V, Salmenperä P, Salvato MS, Sanfaçon H, Sasaya T, Schmaljohn C, Schneider BS, Shirako Y, Siddell S, Sironen TA, Stenglein MD, Storm N, Sudini H, Tesh RB, Tzanetakis IE, Uppala M, Vapalahti O, Vasilakis N, Walker PJ, Wáng G, Wáng L, Wáng Y, Wèi T, Wiley MR, Wolf YI, Wolfe ND, Wú Z, Xú W, Yang L, Yāng Z, Yeh S-D, Zhāng Y-Z, Zhèng Y, Zhou X, Zhū C, Zirkel F, Kuhn JH (2018) Taxonomy of the family *Arenaviridae* and the order *Bunyavirales*: update 2018. Arch Virol 163:2295–2310

3. Makhsous N, Shean RC, Droppers D, Guan J, Jerome KR, Greninger AL (2017) Genome sequences of three novel bunyaviruses, two novel rhabdoviruses, and one novel nyamivirus from Washington State moths. Genome Announc 5:e01668-01616
4. Shi M, Lin X-D, Tian J-H, Chen L-J, Chen X, Li C-X, Qin X-C, Li J, Cao J-P, Eden J-S, Buchmann J, Wang W, Xu J, Holmes EC, Zhang Y-Z (2016) Redefining the invertebrate RNA virosphere. Nature 540:539–543

Affiliations

Piet Maes[1] · Scott Adkins[2] · Sergey V. Alkhovsky[3] · Tatjana Avšič-Županc[4] · Matthew J. Ballinger[5] · Dennis A. Bente[6] · Martin Beer[7] · Éric Bergeron[8] · Carol D. Blair[9] · Thomas Briese[10] · Michael J. Buchmeier[11] · Felicity J. Burt[12,13] · Charles H. Calisher[9] · Rémi N. Charrel[14] · Il Ryong Choi[15] · J. Christopher S. Clegg[16] · Juan Carlos de la Torre[17] · Xavier de Lamballerie[14] · Joseph L. DeRisi[18,19,20] · Michele Digiaro[21] · Mike Drebot[22] · Hideki Ebihara[23] · Toufic Elbeaino[21] · Koray Ergünay[24] · Charles F. Fulhorst[6] · Aura R. Garrison[25] · George Fú Gāo[26] · Jean-Paul J. Gonzalez[27] · Martin H. Groschup[28,29] · Stephan Günther[30] · Anne-Lise Haenni[31] · Roy A. Hall[32] · Roger Hewson[33] · Holly R. Hughes[34] · Rakesh K. Jain[35] · Miranda Gilda Jonson[36] · Sandra Junglen[37,38] · Boris Klempa[37,39] · Jonas Klingström[40] · Richard Kormelink[41] · Amy J. Lambert[34] · Stanley A. Langevin[42] · Igor S. Lukashevich[43] · Marco Marklewitz[37,38] · Giovanni P. Martelli[44] · Nicole Mielke-Ehret[45] · Ali Mirazimi[46] · Hans-Peter Mühlbach[45] · Rayapati Naidu[47] · Márcio Roberto Teixeira Nunes[48] · Gustavo Palacios[25] · Anna Papa[49] · Janusz T. Pawęska[50,51] · Clarence J. Peters[6] · Alexander Plyusnin[52] · Sheli R. Radoshitzky[25] · Renato O. Resende[53] · Víctor Romanowski[54] · Amadou Alpha Sall[55] · Maria S. Salvato[56] · Takahide Sasaya[57] · Connie Schmaljohn[25] · Xiǎohóng Shí[58] · Yukio Shirako[59] · Peter Simmonds[60] · Manuela Sironi[61] · Jin-Won Song[62] · Jessica R. Spengler[8] · Mark D. Stenglein[63] · Robert B. Tesh[6] · Massimo Turina[64] · Tàiyún Wèi[65] · Anna E. Whitfield[66] · Shyi-Dong Yeh[67] · F. Murilo Zerbini[68] · Yong-Zhen Zhang[28,29] · Xueping Zhou[69] · Jens H. Kuhn[70]

✉ Jens H. Kuhn
kuhnjens@mail.nih.gov

1 Zoonotic Infectious Diseases unit, Rega Institute, KU Leuven, Leuven, Belgium

2 United States Department of Agriculture, Agricultural Research Service, US Horticultural Research Laboratory, Fort Pierce, FL, USA

3 D. I. Ivanovsky Institute of Virology, N. F. Gamaleya Federal Research Center for Epidemiology and Microbiology, Ministry of Health of the Russian Federation, Moscow, Russia

4 University of Ljubljana, Ljubljana Faculty of Medicine, Ljubljana, Slovenia

5 Department of Biological Sciences, Mississippi State University, Mississippi State, MS, USA

6 University of Texas Medical Branch, Galveston, TX, USA

7 Institute of Diagnostic Virology, Friedrich-Loeffler-Institut, Greifswald-Insel Riems, Germany

8 Viral Special Pathogens Branch, Division of High-Consequence Pathogens and Pathology, Centers for Disease Control and Prevention, Atlanta, GA, USA

9 Department of Microbiology, Immunology & Pathology, Arthropod-borne and Infectious Diseases Laboratory, Colorado State University, Fort Collins, CO, USA

10 Department of Epidemiology, Mailman School of Public Health, Center for Infection and Immunity, Columbia University, New York, NY, USA

11 Department of Molecular Biology and Biochemistry, University of California, Irvine, CA, USA

12 Division of Virology, National Health Laboratory Service, Bloemfontein, Republic of South Africa

13 Division of Virology, University of the Free State, Bloemfontein, Republic of South Africa

14 Unité des Virus Emergents (Aix-Marseille Univ–IRD 190–Inserm 1207–IHU Méditerranée Infection), Marseille, France

15 Plant Breeding Genetics and Biotechnology Division, International Rice Research Institute, Los Baños, Philippines

16 Les Mandinaux, Le Grand Madieu, France

17 Department of Immunology and Microbiology IMM-6, The Scripps Research Institute, La Jolla, CA, USA

18 Department of Medicine, University of California, San Francisco, CA, USA

[19] Department of Biochemistry and Biophysics, University of California, San Francisco, CA, USA

[20] Department of Microbiology, University of California, San Francisco, CA, USA

[21] Istituto Agronomico Mediterraneo di Bari, Valenzano, Italy

[22] Zoonotic Diseases and Special Pathogens, National Microbiology Laboratory, Public Health Agency of Canada, Winnipeg, MB, Canada

[23] Department of Molecular Medicine, Mayo Clinic, Rochester, MN, USA

[24] Virology Unit, Department of Medical Microbiology, Faculty of Medicine, Hacettepe University, Ankara, Turkey

[25] United States Army Medical Research Institute of Infectious Diseases, Fort Detrick, Frederick, MD, USA

[26] National Institute for Viral Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China

[27] Center of Excellence for Emerging and Zoonotic Animal Disease, Kansas State University, Manhattan, KS, USA

[28] National Institute for Communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Changping, Beijing, China

[29] Shanghai Public Health Clinical Center & Institutes of Biomedical Sciences, Fudan University, Shanghai, China

[30] Department of Virology, Bernhard-Nocht Institute for Tropical Medicine, WHO Collaborating Centre for Arboviruses and Hemorrhagic Fever Reference and Research, Hamburg, Germany

[31] Institut Jacques Monod, CNRS—Université Paris-Diderot, Paris, France

[32] Australian Infectious Diseases Research Centre, School of Chemistry and Molecular Biosciences, The University of Queensland, Brisbane, Australia

[33] Public Health England, Porton Down, Wiltshire, Salisbury, UK

[34] Centers for Disease Control and Prevention, Fort Collins, CO, USA

[35] Division of Plant Pathology, Indian Agricultural Research Institute, New Delhi, India

[36] Department of Agricultural Biotechnology, Center for Fungal Pathogenesis, College of Agriculture and Life Sciences, Seoul National University, Seoul, Korea

[37] Institute of Virology, Charité-Universitätsmedizin Berlin, corporate member of Free University Berlin, Humboldt-University Berlin, and Berlin Institute of Health, Berlin, Germany

[38] German Centre for Infection Research, Berlin, Germany

[39] Biomedical Research Center, Slovak Academy of Sciences, Bratislava, Slovakia

[40] Department of Medicine Huddinge, Center for Infectious Medicine, Karolinska Institutet, Karolinska University Hospital, Stockholm, Sweden

[41] Laboratory of Virology, Department of Plant Sciences, Wageningen University, Wageningen, The Netherlands

[42] Department of Microbiology, University of Washington, Washington, USA

[43] Department of Pharmacology and Toxicology, School of Medicine, and the Center for Predictive Medicine for Biodefense and Emerging Infectious Diseases, University of Louisville, Louisville, KY, USA

[44] Department of Plant, Soil and Food Sciences, University of Bari Aldo Moro, Bari, Italy

[45] Biocentre Klein Flottbek, University of Hamburg, Hamburg, Germany

[46] Folkhalsomyndigheten, Stockholm, Sweden

[47] Department of Plant Pathology, Irrigated Agricultural Research and Extension Center, Washington State University, Prosser, WA, USA

[48] Evandro Chagas Institute, Ministry of Health, Rod BR 316, Ananindeua, Brazil

[49] Department of Microbiology, Medical School, National Reference Centre for Arboviruses and Haemorrhagic Fever Viruses, Aristotle University of Thessaloniki, Thessaloniki, Greece

[50] Centre for Emerging Zoonotic and Parasitic Diseases, National Institute for Communicable Diseases, National Health Laboratory Service, Sandringham, South Africa

[51] Department of Medical Virology, Centre for Viral Zoonoses, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa

[52] Department of Virology, University of Helsinki, Medicum, Helsinki, Finland

[53] Departamento de Biologia Celular, Universidade de Brasília, Barsília, DF, Brazil

[54] Instituto de Biotecnología y Biología Molecular, Centro Cientifico Technológico-La Plata, Consejo Nacional de Investigaciones Científicas y Técnicas—Universidad Nacional de La Plata, La Plata, Argentina

[55] Institut Pasteur de Dakar, Dakar, Senegal

[56] Institute of Human Virology, University of Maryland School of Medicine, Baltimore, MD, USA

[57] Department of Planning and Coordination, National Agriculture and Food Research Organization, Tsukuba, Japan

[58] MRC-University of Glasgow Centre for Virus Research, Glasgow, Scotland, UK

[59] Asian Center for Bioresources and Environmental Sciences, University of Tokyo, Tokyo, Japan

[60] Nuffield Department of Medicine, University of Oxford, Oxford, UK

[61] Bioinformatics Scientific Institute IRCCS E. MEDEA, Bosisio Parini, Italy

[62] Department of Microbiology, College of Medicine, Korea University, Seoul, Republic of Korea

[63] Department of Microbiology, Immunology and Pathology, Colorado State University, Fort Collins, CO, USA

[64] Institute for Sustainable Plant Protection, CNR, Torino, Italy

[65] Fujian Province Key Laboratory of Plant Virology, Institute of Plant Virology, Fujian Agriculture and Forestry University, Fuzhou, Fujian, China

[66] Department of Entomology and Plant Pathology, North Carolina State University, Raleigh, NC, USA

[67] Department of Plant Pathology, National Chung Hsing University, Taichung, Taiwan

[68] Departamento de Fitopatologia/BIOAGRO, Universidade Federal de Viçosa, Viçosa, MG, Brazil

[69] State Key Laboratory for Biology of Plant Diseases and Insect Pests, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, Beijing, China

[70] Integrated Research Facility at Fort Detrick (IRF-Frederick), Division of Clinical Research (DCR), National Institute of Allergy and Infectious Diseases (NIAID), National Institutes of Health (NIH), B-8200 Research Plaza, Fort Detrick, Frederick, MD 21702, USA